enemy's lines of circumvallation, or line of battle, with the wind blowing in his direction, the balloon could be sent up with ballast proportioned to the general elevation intended for its soaring over his position. I have said "general elevation," because change of volume in the balloon, in accordance with the change of temperature, or increased weight on it, from an accession of moisture, preclude the possibility of calculating upon obtaining precise predetermined elevation for the balloon. The weight of the string for the length to be paid out to the contemplated distance would of course enter into the amount of ballast needed to secure an approximately special elevation at a special distance. The distance to the enemy's position being known, and the vertical angle being taken to the balloon from its point of departure, when it is approximately delivered at its destination, the exact remaining length of string, with allowance for sagging, necessary to pay out so as to cause the balloon fairly to dominate the enemy's military works or line of battle, would at once be known by a simple computation, or could be taken from a table of angles and distances. This operation being completely performed at several points along the opposing military lines, a series of pictures, at varying distances from front to rear, and from right to left of the enemy's position could be secured by means of the electro-magnetic attachment to the shutters of the photographic cameras, each individual one of which could take a number of pictures without replenishment of plates. It is evident that such a use of the balloon and the photographic camera would have proved greatly advantageous to either side in such modern sieges as those of Sebastopol, Richmond, and Paris.

On the Skull of the Dinosaurian Lælaps incrassatus Cope.

By E. D. Cope.

(*Read before the American Philosophical Society, May 6, 1892.*)

The characters of the skull in the carnivorous Dinosauria are only partially known, so the present opportunity is improved to add to our knowledge a considerable number of points, if not to exhaust the subject. I have temporarily in my possession two incomplete crania of the *Lælaps incrassatus*, from the Laramie formation of the Red Deer river, in the Dominion of Canada, which have been submitted to me by the Geological

Survey of the country for determination and description. I express here my thanks to the honorable Director of the Survey, Dr. A. R. C. Selwyn, for the opportunity of examining these important specimens.

The first specimen consists of the skull, from the orbits to the muzzle inclusive, with the two dentary bones with teeth adhering to the inferior surface. The second specimen includes most of the parts absent from the first. The muzzle and orbital region are wanting, but the parietal and occipital regions are present, with the basis cranii and palate; parts of the quadrate bones and both mandibular rami nearly complete with teeth.

The bones of the skull are dense and light, and some of them are pneumatic. The sutures separating the premaxillary, maxillary and nasal bones are not distinguishable in the specimen, and both are considerably injured. There is a large subround preorbital foramen whose centre is a little nearer the superior plane of the skull than the alveolar border. It is separated from the orbit by a narrow isthmus. The frontal bone is very narrow between the orbits. The prefrontal forms a vertical convex crest on each side, as represented by Marsh to exist in the *Megalosaurus nasicornis*. The orbits are longitudinally widely parallelogrammic, and are of enormous size, equaling in long diameter the length of the muzzle in front of them. The postfrontal and postorbital elements appear to be fused, and form an L-shaped bone, whose horizontal limb is supraorbital, extending forwards over the orbit anterior to its middle, and terminating in an acute apex. The other limb is vertical and postorbital, extending to the jugal bone. A small piece on the inner side of the postfrontoörbital at its posterior angle on the superior face of the skull is of uncertain determination. The maxillary diminishes rapidly in depth below the orbit and terminates a little posterior to it. The jugal overlaps it above, and probably terminated at about the posterior third of the orbit, but the suture is not clear at this point. The frontal is supported below by two vertical elements posterior to the middle of the orbit. These closely resemble the corresponding pieces in Sphenodon, and are the postoptic* and epipterygoid respectively. They are preceded by a vertical compressed element which corresponds with the orbitosphenoid of Sphenodon, but it is not perforate, and the optic foramen is posterior to it. It is elongate anteroposteriorly, and its anterior extremity is concealed anterior to the orbit. The postoptic is strongly concave at its anterior margin, and the inferior part of this border is produced anteriorly. The epipterygoid, on the other hand, is openly concave posteriorly, its inferior portion being directed posteriorly and enclosing a large foramen with the postoptic. The external face of the maxillary bones is rugose with fine ridges, and rather numerous foramina. The jugal extends well posteriorly, and increases in depth, but its posterior extremity is broken from the specimen.

The mandibular rami are compressed, and the symphysis is oblique and ligamentous. The dentary bone is followed posteriorly above by a deep surangular, with rounded superior border, whose superior outline, though

* For the definition of this element, see Proc. Amer. Philos. Soc., 1892.

convex, rises but little above the level of the dentary. The dentary is produced below it. On the inner side is seen a large splenial foramen, from which extends anteriorly a narrow strip, the splenial. The other borders of the foramen are formed by a large laminiform bone, the opercular of Cuvier, which extends to the superior border of the ramus, cutting off the dentary posteriorly. It is apparently homologous with the inferior anterior part of the coronoid. For the remaining parts of the mandibular ramus see the description of the second specimen. The external face of the dentary is roughened and presents foramina which are most numerous anteriorly, where they are connected by shallow grooves, like the rims between the holes of small Mammalia. Opposite each tooth is one or two shallow vertical grooves.

The teeth have the usual Megalosaurian form and have long roots sunk in very deep alveoli. There are eleven present in the maxillary bone, of which the terminal ones are rapidly reduced in dimensions. Fourteen teeth in the dentary bone which diminish in size at the posterior end of the series. The premaxillary teeth are lost, but none of those in the anterior part of the dentary bone have the incisor-like character of those of the genus Amblypodon of Leidy. The first tooth of the dentary is smaller than the second, and both have more convex external faces than the teeth which succeed them.

Measurements of Skull No. 1.

	MM.
Total length of specimen	600
Length (axial) to front border of preorbital foramen	140
Length to anterior border of orbit	215
Length to posterior border of orbit	385
Vertical diameter of orbit	120
Vertical diameter of skull at middle of orbit	180
Width of front at middle of orbit	80
Depth of dentary at posterior end of symphysis	90
Depth of dentary at end of dental series	127
Length of dental series	320
Length of dentary bone above	390
Length of sixth tooth above alveolus	57
Width of sixth tooth at alveolus	22

In the second skull the only part of the superior portion remaining is the brain case, and this is distorted by pressure which has forced it to the left side of the middle line. The postorbital region and the arches are gone. The occipital appears to be continuous and subhorizontal and is obtusely angulate medially above. The basioccipital is vertical as in the crocodiles proper, and the brain case is closed in front of the petrosal in much the same way, with thin ossifications. The foramen magnum is small, as is also the transversely oval occipital condyle, which looks directly posteriorly, and not downwards. On each side of the basioccipital are two large

foramina, one above the other, the inferior issuing in a deep groove or fossa. They are bounded externally by a broad vertical ala. Anterior to this ala are two other large foramina, one above the other, both issuing from fossæ. One or both of these is the trigeminal. The middle line of the brain case is keeled below, except near and at the anterior extremity, where it is flat and is perforated by a transverse foramen. This is possibly a pituitary foramen, which thus penetrates the palatal roof as in the Opisthocœlus Dinosauria as stated by Marsh.

The rami of the mandible are pressed obliquely against the inferior aspect of the skull, but are separated far enough to permit the palatopterygoid elements to be seen. These form a rather narrow, flattened rod on each side the middle line, which extend to the robust basipterygoid processes, which look downwards. Each pterygoid then turns abruptly outwards with its edge downwards towards the quadrate, but the specimen does not permit me to discover whether it reaches that element or not. It sends a robust process to the inner side of the basipterygoid, thus extensively embracing it. The anterior part of the palate is invisible.

The relations of the dentary and surangular bones are the same as in the specimen No. 1. This specimen shows that the angular and articular are distinct elements. The angular is an elongate element, which is extensively exposed anteriorly on the internal face of the ramus, and then passes to the external face, terminating in an acuminate lamina below the articular cotylus, but not reaching the angle. The articular is only developed anteriorly on the internal border of the ramus, where it extends well forwards, extensively overlapping the angular. The surangular extends posteriorly to the borders of the articular cotylus, and spreads out below the articular as though it would enter into the composition of the angle of the jaw, which it does not. It is perforated by a round foramen near its interior border, and its inferior face is separated from the external face by a prominent longitudinal down-looking angle. The articular cotylus is transverse and is not bifossate. The quadrate contracts immediately above its condyle and is then broken off in the specimen, but it probably has a rather slender shaft.

There is a large foramen in the internal wall of the ramus which is bounded below by the articular.

A singular bone occurs in both skulls whose position I cannot determine. It is a slender, strongly curved cylindric cone, which rises from the posterior palatal region and turns upwards, outwards and then backwards and a little downwards, with a compressed acute apex. It is not articulated with any element at the apex, which lies near the jugal bone, and its basal connections are broken away in both skulls. It is possibly a part of the hyoid apparatus, but if so it is difficult to identify it with any known element. The hypohyal is more appropriate than any other, but I do not make any identification.

Measurements of Skull No. 2.

	MM.
Length of supraoccipital on middle line	170
Length of supraoccipital including occipital condyle	230
Width of basioccipital posteriorly	155
Width of foramen magnum	35
Diameters occipital condyle { vertical	40
Diameters occipital condyle { transverse	70
Width of distal end of quadrate	135
Total length of mandibular ramus	950
Length of dentary above	480
Length of fourth tooth from alveolus	55
Width of fourth tooth at alveolus	27

History.—I described this gigantic reptile in the Proceedings of the Philadelphia Academy for October, 1876, from teeth derived from the Laramie formation of Montana, and afterwards (*l. c.* December, 1876, p. 340), I described it more fully from a nearly entire dentary bone with teeth from the same region. This individual did not differ much in dimensions from those now described.

Our knowledge of the structure of the cranium of the carnivorous Dinosauria has been very slowly acquired. Buckland and Mantell originally knew only the mandibular rami, but Phillips much later obtained a maxillary bone. From these fragments he proposed a restoration on the basis of the skull of the Lacertilia, with but a single postorbital bar. In this kind of restoration Prof. Owen coincided on the occasion of his description of another maxillary bone in the Quarterly Journal, Geological Soc. of London, 1883, p. 334. In a figure of a restoration, he adopted the Lacertilian model instead of the Crocodilian, and he therefore inserted a triangular postorbital, and an elevated coronoid element. He also omitted the preorbital foramen. Dr. J. W. Hulke, at that time President of the Geological Society, expressed the opinion, on hearing Prof. Owen's paper, that Megalosaurus has two postorbital bars, an anticipation proven to be correct at a later date. In 1884, Prof. Marsh published a paper which contains a description of the skull of a species of carnivorous Dinosaur which he calls *Ceratosaurus nasicornis*. While this animal is probably a species distinct from the *Megalosaurus bucklandii*,* it has not yet been shown to belong to a different genus. In this paper the presence of a zygomatic arch like that of the Crocodilia is demonstrated for this sole order, and the preorbital foramen is also described. The general and more obvious characters of the cranium are given, but many of those which are necessary for an exact understanding of the position of the genus are not given ; especially are the characters

* Amer. Jour. Sci. Arts, 1884, p. 330. It has been shown that the character on which Prof. Marsh relied to distinguish the genus Ceratosaurus, and the family Ceratosauridæ, viz., the confluent metapodials, is pathological. The keeled process on the nose is probably only a specific character.

of the mandibular ramus omitted. In the present paper these omissions are mostly supplied, but a number of important problems remain to be definitely settled. See Trans. Amer. Philos. Soc., 1892, Vol. xvii, p. 17, where one of these is stated. I pointed out in 1866, when the genus Lælaps was described, and later, in 1869 (Vol. xiv, Trans. Amer. Philos. Soc.), that it differs from Megalosaurus in the much more acute and compressed claws. I add that the present species differs from the *M. nasecornis* of Marsh in the much larger and more anteriorly placed orbits, and in the much smaller prerobital foramen.

Figures of these remains will be given in the final publication by the Geological Survey of Canada.

Addition to the Note on the Taxonomy of the Genus Emys C. Duméril.

By G. Baur.

(*Read before the American Philosophical Society, May 6, 1892.*)

In a discussion about the type of Emys with Dr. L. Hejneyer, this gentleman called my attention to the fact that, according to the Code of Nomenclature adopted by the American Ornithologists' Union, the type species could not be *T. picta*, because this species is not named by Brogniart. According to his view not only the name *Emydes* ought to be used, as originally introduced by Brogniart in 1805 (Emys Dum., 1806), but also one of the species enumerated by Brogniart taken as the type. Brogniart mentions the following species with his genus *Emydes: E. ferox, E. rostrata, E. matamata, E. lutara, E. pensilvanica, E. clausa.* In 1806 Duméril referred the *E. matamata* to a new genus *Chelus ;* in 1809 Geoffrey *E. ferox* and *E. rostrata* to *Trionyx, E. pensilvanica* belonging to *kinosternon* Spix ; either *E. lutaria* or *clausa* has to be considered as type of Emydes. *E. lutaria* = *T. orbicularis* L. being the common Emysæan form, ought to be taken as type of *Emydes*, and *E. clausa* = *T. carolina* L. ought to be considered as type of *Terrapene* Merrem., of which Cistuda Fleming is a synonym.

According to this we would have the following :

Emydes Brogniart, 1805,
Type, *T. orbicularis* L.
Terrapene Merrem, 1820,
Type, *T. carolina* L.
Chrysemys Gray, 1844,
Type, *T. picta* (Herrm. MSS.) Schn